2002 International Infantry & Joint Services Small Arms Systems Symposium

Delivery of Non-Lethal Mortar Payloads

by Mortar Systems

Joint RDT&E Pre-Milestone A Program

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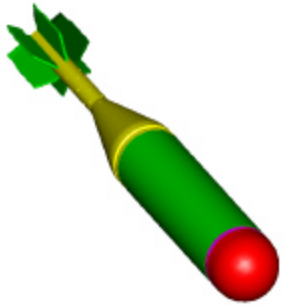


Background

Existing Non Lethal Capability Set range-limited. In 1998, Joint Non Lethal Weapons Directorate sought industry proposals for long range non-lethal delivery systems. Two winning proposals both mortars solutions. Contracts awarded 3 years ago this month. September 2000, ARDEC asked to manage overall program

The Challenge

Non-lethal Mortar must meet a stringent Kinetic Energy Criterion: No portion of the cartridge can impact the target area with a KE greater than 58 ft-lbs. Typical mortar cartridge weighs several pounds and impact velocities exceed 300 ft/sec. Conventional design concepts won't work, positive measures must be taken to mitigate the KE before impact.

Current Status

At the present time, the IPT is evaluating the efficacy of several Terminal Kinetic Energy approaches being investigated, and starting to define the overall cartridge design. There are many issues and challenges to be met in applying mortars technology to this requirement.

We are working with the OIWC Team as they have a similar problem.

DoD Directive 3000.3, 9 Jul 96
Policy for Non-lethal Weapons (NLW)

. . . **Designates** . . . Commandant of the Marine Corps
Executive Agent for the DoD NLW Program . . .

. . . **Defines NLW** . . . "weapons that are explicitly designed and primarily employed so as to incapacitate personnel or materiel, while **minimizing** fatalities, permanent injury to personnel, and undesired damage to property and the environment."

. . . **Directs** . . . Services to participate in NLW program

Army Roles in NLW

Single Proponent for U.S. Army Non-Lethal Applications

- The U.S. Army Military Police School (USAMPS, at Fort Leonard Wood, MO) is the designated single proponent for Army Non-Lethal Applications, effective 12 Sep 00.

- USAMPS will serve as the U.S. Army Training and Doctrine Command's single voice for all developments and initiatives to field NL capabilities.

Army Roles in NLW

Project Manager for Mines, Countermine and Demolitions

- The Project Manager – Mines, Countermine and Demolitions (PM-MCD), located at Picatinny Arsenal, NJ, has program management responsibility for Army Non-Lethal Materiel programs, and establishing the Army's Non-Lethal Capability Sets.
- PM-MCD sits on NATO LG 9 on Combat Engineering.

Systems Manager for U.S. Army Non-Lethal Technology Integration

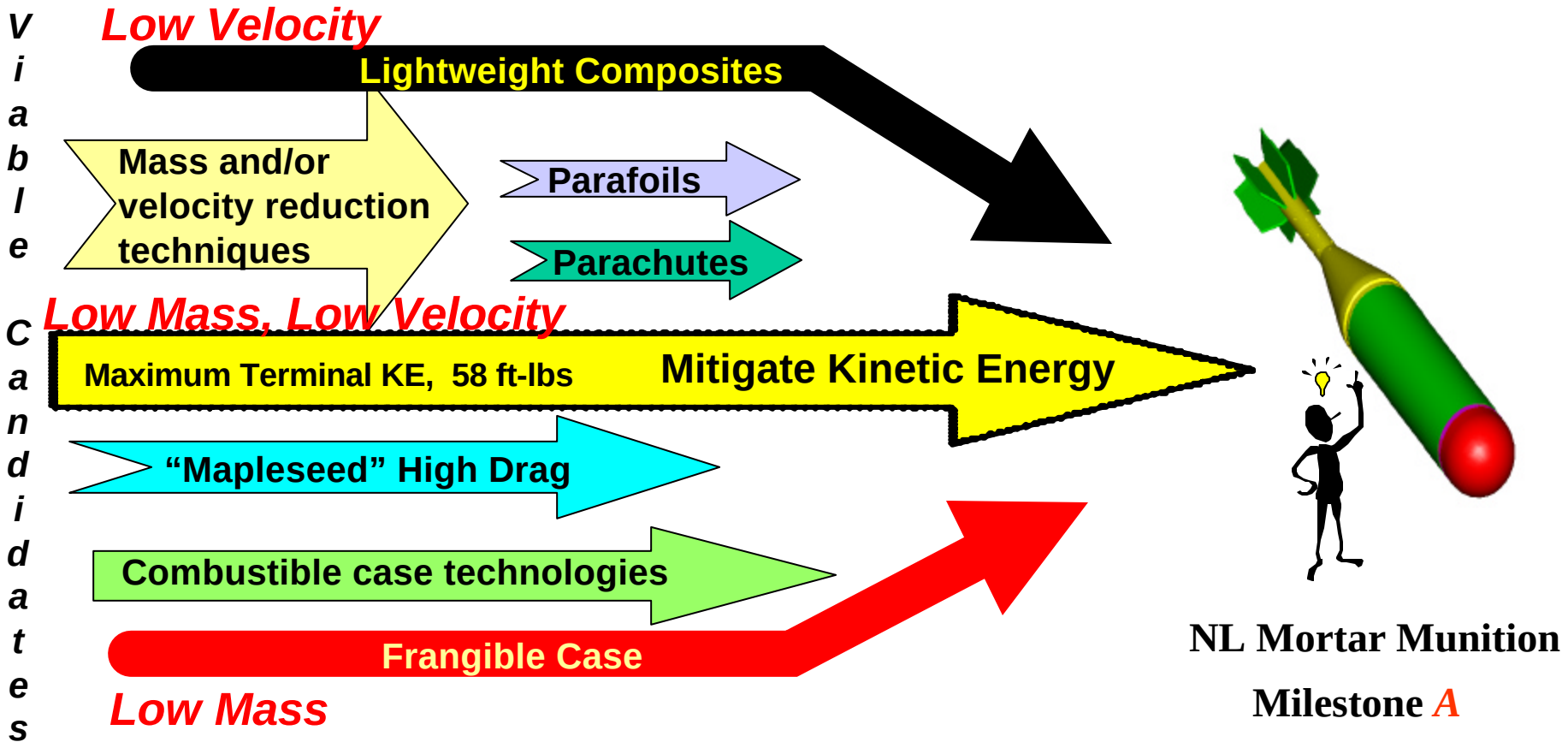
- The Tank-automotive and Armaments Command - Armament, Research, Development and Engineering Center (TACOM-ARDEC), Close Combat Armaments Center (CCAC), located at Picatinny Arsenal, NJ, has responsibility for leading coordination of Army NL Technology development.
- CCAC sits on NATO LG 3, Close Combat Infantry.

K.E. mitigation techniques

- Several K.E. mitigation techniques have been defined
  - Lightweight Composites
  - Parachutes/Parafoils
  - “Mapleseed” High Drag
  - “Brooming”
  - Frangible Case
  - Combustible Case
  - Any other mass and/or velocity reduction technique

NL Down Select Options

To Get To End State



Key objective: mitigate Terminal Kinetic Energy

A major challenge will be to come up with a cartridge that can meet all applicable weapon Requirements without exceeding non-lethal Kinetic Energy Criteria. All approaches, weight reduction, combustible cartridge, velocity mitigation, etc will be explored.

Requirements

MS A Exit Criteria

Criterion	Threshold	Goal
• Cartridge Size	81mm	60 – 120mm (Scaleable)
• Range	200-2500m	200-5100m
• Maximum Terminal KE	58 ft-lbs	25 ft-lbs
• Payloads	Liquid, Aerosol, Powder, Solid	Same
• Area Coverage	Type of Payload Dependent	25m ² min
• Delivery Accuracy	One PE*<15M up to 1500m	One PE*<15m up to 1500m & <1% beyond 1500m

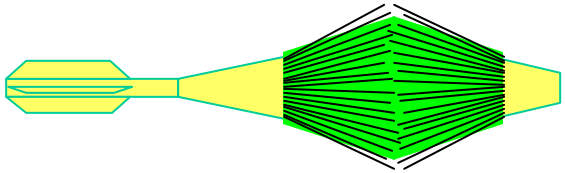
* PE= Probable Error

M2 Technologies, Inc.

M2 Mass Mitigation Approaches

Brooming Composite Casing Concept

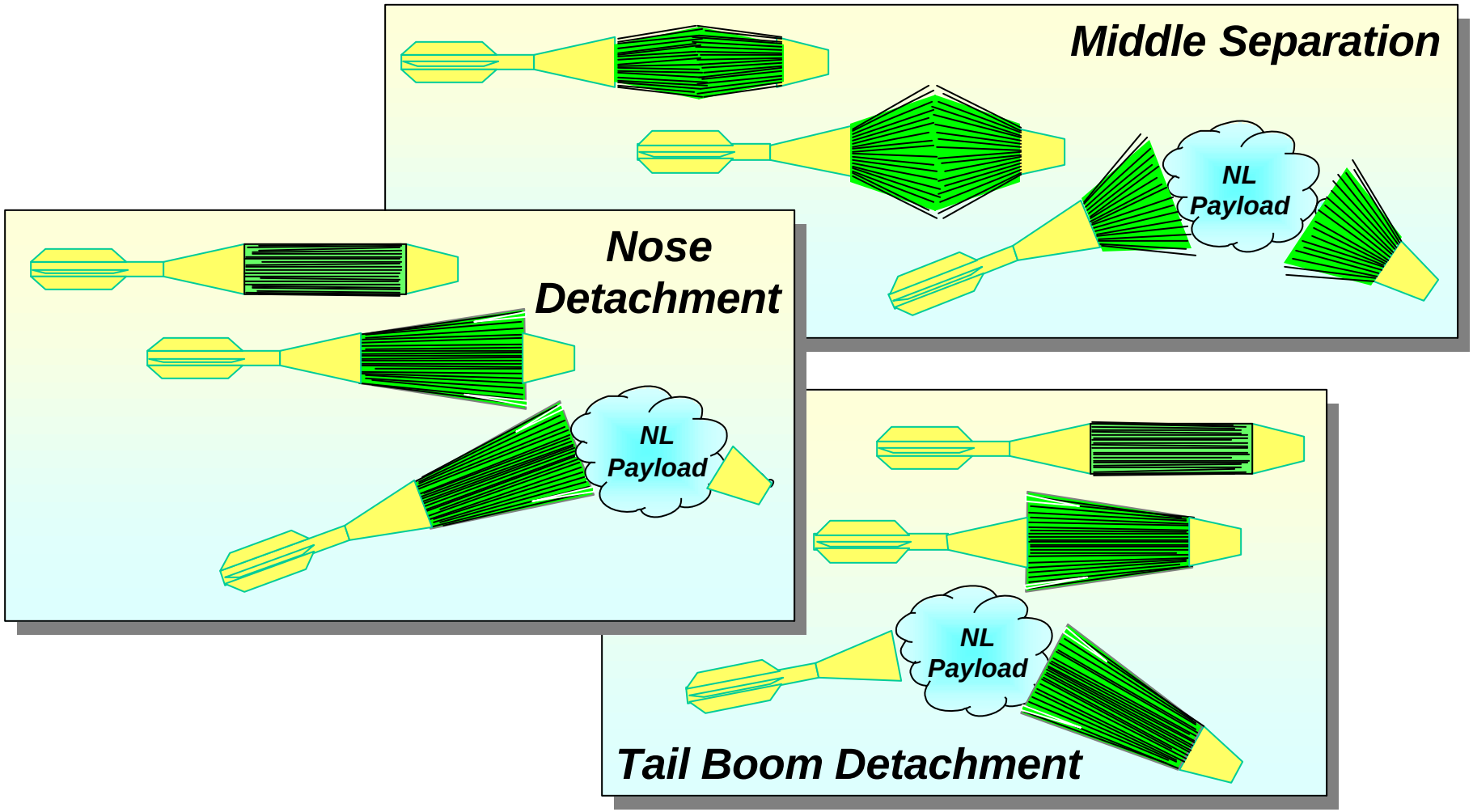
- *Filament Wound or Pultruded Shell*



- *Low Cost GL/Polymer Materials*
- *Stress Induced Matrix Disruption and Resulting Fiber Brooming*
- *Casing breakup initiated via gas generator*
- *Solid, Liquid, Powder Payload Flexibility*
  - *- Bladder*
  - *- Sleeve*

M2 Mass Mitigation Approaches

Brooming Concept Execution Options



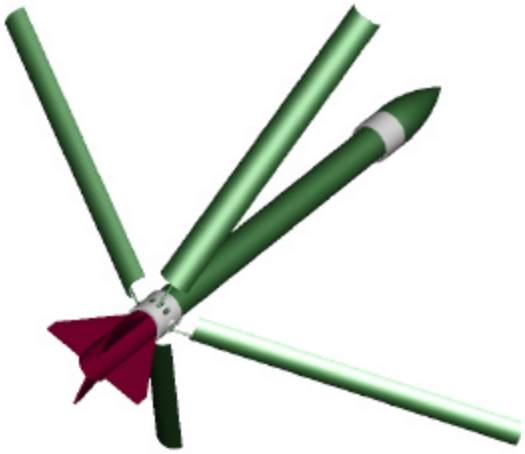
M2 Mass Mitigation Approaches

45 Degree S-Glass Cylinder Burst Test Specimen

United Defense

Mapleseed

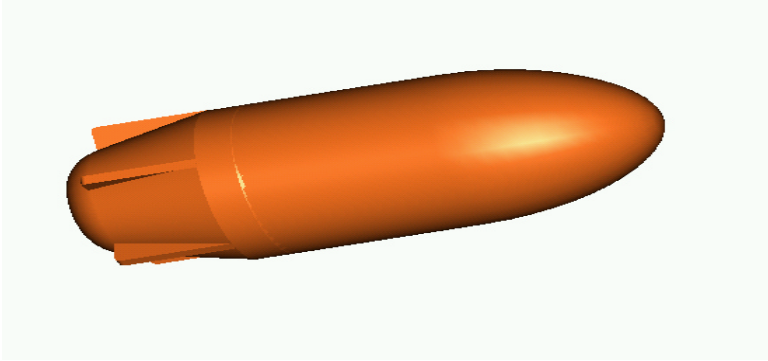
Rotor Deployment Sequence



- Testing of the mapleseed scheme to optimize its drag and/or lift.
- UDLP began investigation of cost effective ways to fabricate the composite bodies and nosecones.

ARMTEC work :

- Develop a method for successful launch of NL payload carrier from 120mm mortar system. High angle of fire weapon system optimal for MOUT Operations.



- Establish payload capability for this system.
- Establish the circular error of probability (CEP) for payload.
- Work with ARDEC in follow-on development of payload and deployment system.

TACOM-ARDEC

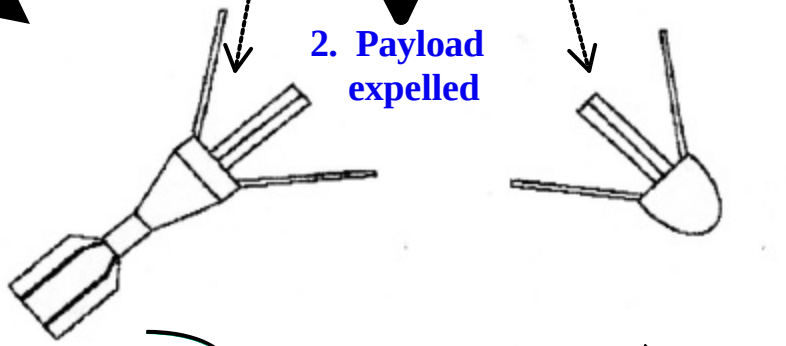
Velocity Mitigation

In House NL Mortar Concepts

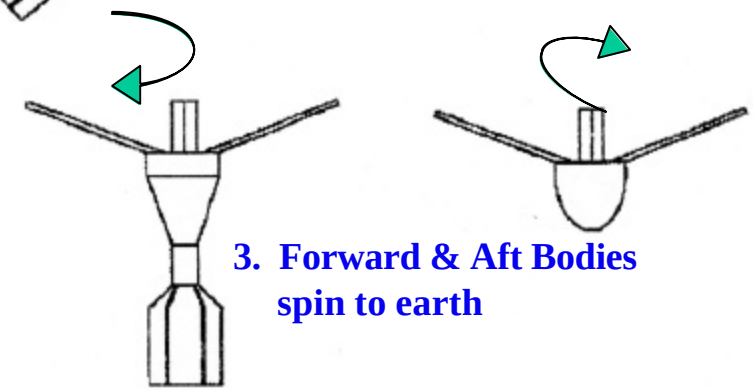
Double Vane Decelerator *

OPERATIONAL SEQUENCE

1. Munition divides into forward and aft



2. Payload expelled



3. Forward & Aft Bodies spin to earth

8 Interlocking Vanes form centerbody

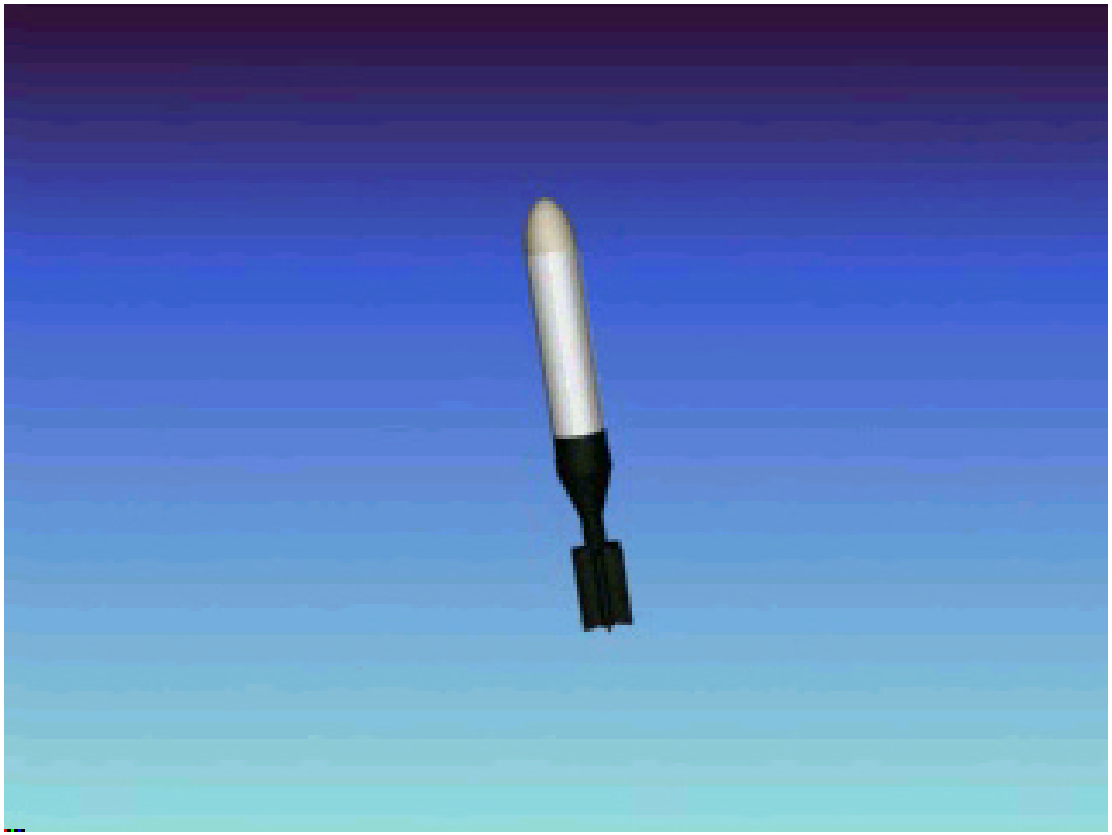
Interlocking Vane

*Patent pending

Upcoming Associated Activities

Jan 02 – Feb 02	Testing of In-House Design	Picatinny & Wright Paterson
May 6	phase II	“

In House NL Mortar Concepts



In House NL Mortar Concepts

TACOM-ARDEC

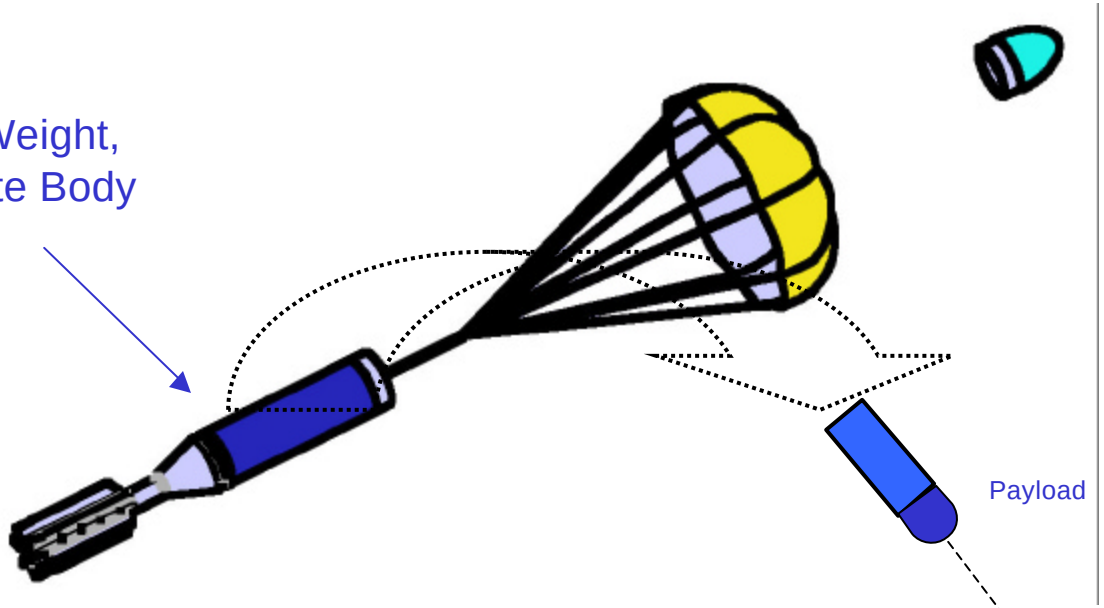
Single Parachute-Lightweight Composite

TACOM-ARDEC

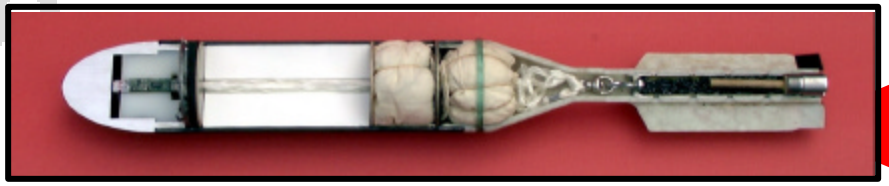
In House NL Mortar Concepts

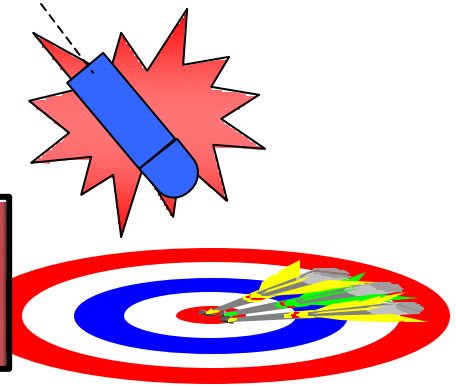
Fuze in rear

Light Weight,
Composite Body



Lightweight (composite) Vehicle with 2 Parachute Delivery





Program Status

- Pre-Milestone A Program
- Bench Tests, Static Firings, Wind Tunnel Testing ongoing
- Milestone A Scheduled for 3QFY03
- Demo Firings 2QFY03: TRL 4